

Technical Memorandum 5B

Hydrologic Aspects of the Wetland Disposal Alternative

Draft
September 2004

Only sections or other elements of Technical Memorandum 5B revised for the Final EIS are included here. These changed sections combined with the unchanged sections of Technical Memorandum 5B in the Draft EIS constitute Technical Memorandum 5B of the Final EIS. Please see the introduction to the “Changes Made in the Draft EIS in Response to Comments” section for a full explanation.

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1.0 Introduction

One of the disposal options being evaluated for the proposed Carnation Wastewater Treatment Facility is to discharge highly treated wastewater effluent to wetlands in the Washington Department of Fish and Wildlife (WDFW) Stillwater Wildlife area north of Carnation. One goal of this discharge option is to provide the beneficial reuse of highly treated wastewater in wetland enhancement. This possible beneficial use of the discharge water has been supported by WDFW who owns and operates the wildlife area. Additionally, Ducks Unlimited, an organization that promotes wetland conservation, has also expressed interest in partnering with King County in a wetland enhancement project.

The general plan would be to deliver the water to three designated wetlands on the property where it could support and possibly enhance the hydrology of those features, particularly during the dry months of summer and early fall. Application of up to 440,000 gallons per day (gpd) is anticipated to be available to the wetland features. The intent of this study is to characterize the hydrologic and hydrogeologic setting of the Stillwater area and use this characterization to assess the potential affects of the application of treated waste water on the wetlands and the area in general.

The Stillwater Wildlife Area is situated completely within the floodplain of the Snoqualmie River, approximately three miles north of the City of Carnation (City). The property is dominated by several abandoned channel remnants, known as oxbows, separated by terraced upland areas that, until recently, were being farmed. Effluent delivery is proposed to be through a pipeline that carries water from the treatment plant near Carnation, north to the Stillwater Wildlife Area along King County's Snoqualmie Valley Bike/Hike Trail. Discharge has been proposed at three separate locations within the Stillwater area. Detailed information regarding the locations and specific-site characteristics of each location are discussed in subsequent sections of this report.

3.3 Potential Impacts of the Wetlands Disposal Alternative

The wetland disposal alternative at the Stillwater site includes both a basic and expanded option. The basic option includes the creation of new wetlands on the property and the hydrologic enhancement of an existing wetland. The expanded option includes installation of large woody debris clusters or structures at several locations on the unnamed and Harris Creeks. Both options are discussed in detail in Chapter 3 of the Carnation Wastewater Treatment Plant EIS.

Each of the two new wetlands would range in size between six and eight acres with as much as two acres of open water planned in each. The wetlands would be built within existing depressions that now exist north of the unnamed stream in the center of the site. Excavation, if accomplished at all, will be minimal and, therefore, presumably will not penetrate the silt and clay of the uppermost geologic unit. This unit becomes a critical component in the hydrologic response to the wetland enhancement plan. The very low hydraulic conductivity of the unit in conjunction with the inherently low gradients associated with floodplain environments make the anticipated groundwater interaction with the wetland very minor. The Groundwater flow rate through these silt- and clay-rich materials is estimated to be at least several orders of magnitude lower than the 440,000 gpd proposed delivery rate for the reclaimed water. It is also significantly lower than the evapotranspiration that is predicted for the wetlands proposed to receive the reclaimed water.

Since the primary benefits of the wetland-discharge alternative will be realized during the dry season, the precipitation on the property and hydraulics related to the streams is not a principal factor in determining hydrologic advantages. It is clear that the delivery of 440,000 gpd to the wetlands (approximately 220,000 gpd for each of the two wetlands on average) will be the primary source of water during the dry season between May and October. The evapotranspirative losses over a six-acre wetland are expected to be approximately 30,000 gpd through the same period. In contrast, the flow of groundwater through the silt and clay unit against a hydraulic gradient of 2 feet per 1000 lateral feet (.002) are expected to be no greater than one gallon per day across the entire width of the wetland area. Clearly the hydrology of the wetland during the dry season will be dominated by the inflow from the treatment plant discharge and losses through evapotranspiration and the surface discharge over the spillway for a given wetland rather than any gain or loss from or to ground water. Without flow out of the wetlands, the 440,000 gpd input of reclaimed water could support as much as 90 acres of wetland before the inflow is completely balanced by evapotranspiration. However, since the wetland discharge option calls for discharge into only a limited amount of new and existing wetlands, as much as 190,000 gpd of water could be discharged from each of the wetlands into the riparian habitat associated with the streams that cross the Stillwater site.

Most of this potential 380,000 gpd flow out of the two new wetlands would discharge to the unnamed creek. Under the expanded option, modifications to the unnamed creek and its associated wetlands would be made, not to expand their acreage, but to allow them to be inundated for longer periods. This creek and its associated wetlands cover approximately 43 acres. Assuming similar evapotranspiration rates as before, approximately 215,000 gpd may be transpired and evaporated through the unnamed creek and its associated wetlands. This leaves approximately 165,000 gpd ultimately discharging from the unnamed creek to the Snoqualmie River.

The effects on the water quantity and flood flows of the surface waters in the vicinity of Stillwater Water Wildlife Area were also considered. The floodplain is known to be inundated regularly. The prudence of discharging water into a flooded property is bound to be questioned by the community. However, when we consider the flow rates of the delivered water in the context of the average and peak flows associated with the Snoqualmie River, or even the peak flows of Harris Creek, it quickly becomes clear that the 440,000 gpd proposed delivery from the treatment plant is not significant. The 440,000 gpd is equivalent to 0.68 cfs. Very little of it will be lost to evapotranspiration during the wet season. This 0.68 cfs must be compared to the 50 cfs average flow or the 400 cfs peak flows of Harris Creek. Not surprising, these numbers pale in comparison to the 3,700 cfs average flow and 15,500 cfs peak flows of the Snoqualmie River measured in the river near Carnation. Placed in this context it is clear that the water being delivered from the treatment plant during the wet season is insignificant to the natural flows. As such, the discharge of the water will not increase the effects of flooding or the erosional aspects of the channels that carry it. No detrimental effects are expected from these discharges during the wet season due to the de minimis nature of the flows being added.

There is another impact that needs to be considered that may result from flooding. As a flood event occurs on the Snoqualmie River, the new wetlands and the ponded areas created by structures placed within creeks (both in the unnamed creek and in Harris Creek in the expanded option) will be more susceptible to being filled with sediments being carried by the floodwater. The natural tendency is for depressions within a floodplain to be filled by flood event deposition. This is countered in the creeks by the erosional processes associated with high flow events in these streams. However, the relatively low flows and the inherently low gradient of these streams as they cross the Stillwater area make these processes fairly ineffective in countering the larger depositional processes of the flooding Snoqualmie itself. Additionally, the sediment load of the smaller streams will also be trapped by the structures, adding to the filling of the created ponds. Further, the wetlands will be created to have essentially no erosive conditions. Though the trapping of sediments is an issue and eventually (without intervention) the wetlands and ponded areas within the streams will be filled in, this sedimentation is likely to be a relatively slow process. The anticipated delivery of sediments will take a very long time to fill the oxbows and channels involved. The detrimental effects of sedimentation must be weighed against the added habitat benefits of the structures likely can be countered by occasional maintenance.

Water quality is another aspect of the wetland hydrology that needs to be considered when discussing the hydrologic effects of this proposed discharge option. The fact that the reclaimed water will be treated to Class A standards eliminates many of the issues typically associated with treatment plant discharge. The water quality of the treated effluent will be essentially the same or better than the surface water and ground water that currently feed the Stillwater area. The method of delivery with water upwelling through gravel will emulate spring activity typical of the region. The physical properties of the water will be controlled at the treatment plant, and any potential thermal loading (elevated temperature) will be nullified by the predicted exchange of heat with the surrounding ground as the effluent flows through the three miles of buried pipe between the plant and the Stillwater site. The residence time in the pipeline will be approximately 2½ hours. Assuming a temperature differential of 20 degrees Fahrenheit between the temperature of the water leaving the plant and the eventual ambient temperature surrounding the transmission line (assuming steel pipe is used), heat exchange on route to the Stillwater site could potentially lower the temperature of the water as much as 10 degrees.